IN THE SPECIFICATION:

Paragraph beginning at line 11 of page 1 has been amended as follows:

Dynamic measurements (Dynamic Force Microscopy: DFM mode) in Scanning Probe Microscopy (SPM) where displacement and other physical quantities are detected while driving a cantilever fitted with a probe at a distal end in the vicinity of it's resonant frequency so as to obtain an image and carry out observation is well-known. With this type of scanning probe microscope in the related art, a cantilever having a microscopic probe at a distal end is fixed to a cantilever holder. Then cantilever is then made to oscillate at a frequency in the vicinity of its resonant frequency by oscillating means employing a piezoelectric element, etc., and the amplitude at this time is measured by displacement detection means. Optical lever methods where the back of the cantilever is a mirrored surface are used as the displacement detection means. A sample is mounted on a stage having a tri-axial fine adjustment mechanism constructed from a piezoelectric element, etc., that performs X-Y plane scanning and Z-position adjustment. When the sample comes close to the probe as a result of a coarse adjustment mechanism, when the probe and the sample are sufficiently close, physical forces,

such as interatomic forces, act between the sample and the probe. The amplitude of oscillation of the oscillated cantilever therefore changes due to the cantilever being subjected to such physical forces. The force acting at this time depends on the distance between the probe and the sample. When the probe and the sample come within a region where an interatomic force acts, when distance between the sample and the probe is controlled using a Z-position adjustment function so that amplitude of oscillation of the cantilever is normally fixed while scanning within a two-dimensional plane using a fine adjustment mechanism, the extent of this control (displacement) corresponds to the unevenness of the sample surface. A TOPO (uneven shape) image of the sample surface can then be obtained by putting the amount of control during this time into the form of an image.

Paragraph beginning at line 21 of page 2 has been amended as follows:

In the case of performing measurement dynamic (DFM mode) using as scanning probe microscope, a frequency characteristic for the vicinity of the resonance point of the cantilever or probe is obtained (as shown in FIG. 12 ~~11~~) prior to the measurement. A resonance frequency ω_0 and a quality factor ("Q") value are obtained for the cantilever and the

probe from the waveform for this frequency characteristic. The Q-value can normally be obtained from the following formula;

$$Q = \omega_0 / (\omega_2 - \omega_1)$$

Paragraph beginning at line 23 of page 14 has been amended as follows:

~~FIG. 10 is~~ FIGS. 10-10B show a comparative view of a microscope image observed for a soft sample using a low moment probe where Q-control is not performed.

Paragraph beginning at line 10 of page 15 has been amended as follows:

The high-resolution scanning probe microscope of the present invention is equipped with a function for controlling Q in the vicinity of resonance of a cantilever, improves stability of operation when measuring various physical quantities, and improves measurement sensitivity, reproducibility of measurement values and quantitativity. First, FIG. 1 shows the basic configuration of a Q-control system executing Q-value (quality factor value) control forming the basis of the present invention, and a description of the theory of operation is given. A cantilever 1 having a microscopic probe 2 at a distal end is fixed to a cantilever

holder. A signal of a frequency in the vicinity of the resonance frequency of the cantilever is supplied by the oscillator 4, is received by excitation or vibrating means 3 employing piezoelectric elements, etc., and excites the cantilever 1. The back surface of the cantilever 1 is a mirrored surface and an oscillation amplitude of the cantilever ~~at this time~~ is detected at this time by displacement detection means 5 of a light lever, etc. A displacement signal detected by the displacement detection means 5 is amplified by a preamplifier 6. This signal is a sinusoidal signal and as such can be converted to a direct current signal as a result of a converter 7 subjecting the signal to a root means square conversion. The converted signal is then fed back to the oscillator 4 as a DFM control signal. According to this configuration, a DFM control system is first formed. The Q-control system of the present invention inputs an output signal form the preamplifier 6 to a variable gain amplifier 9 via a phase shifter or converter 8 constituting extracting means. The signal amplified at an appropriate set gain is then first superimposed with the output of the oscillator (OSC) 4 using an adder to make a further signal. This signal is then taken as the drive signal for the excitation means 3. The Q-value is then controlled effectively by adjusting the gain. This corresponds to

actively changing the amount of damping due to viscosity of the cantilever.

Paragraph beginning at line 18 of page 16 has been amended as follows:

Next, a description is given of the theory of operation of this Q-control. An equation of motion for the cantilever forcibly oscillated by excitation means such as a piezoelectric element, etc., receiving a drive signal ($F(t)=F\sin(\omega t)$) is as follows:

Paragraph beginning at line 7 of page 17 has been amended as follows:

In the system shown in FIG. 1, a signal that is a displacement detection signal for the cantilever 1 phase-shifted by n/2 by the phase-shifter 8 is amplified by a gain G set at a variable gain amplifier 9. This signal is ~~the~~ then added so as to be superimposed with a sinusoidal forced oscillation signal of the oscillator 4 so as to cause the cantilever to resonate and control the Q-value in an effective manner. Because the displacement detection signal is a sine wave, the signal $\sin(\omega t+\Pi/2)$ phase-shifted by just $\Pi/2$ corresponds to a differential value, and the equation of motion for the cantilever becomes;

Paragraph beginning at line 8 of page 21 has been amended as follows:

The block diagram of FIG. 2 shows the basic configuration for the system for ~~pattern~~ patterns 2 and 3 where, under vacuum conditions, adjustment takes place to lower an excessively high Q-value, TOPO measurement is carried out, and phase measurement is executed using the same Q-value, or Q-value is made high and sensitivity increased under atmospheric conditions, TOP measurement is carried out, and phase measurement is executed using the same Q-value. A phase measurement unit 10 is provided in the basic configuration for Q-control of the present invention shown in FIG. 1. A displacement signal for a cantilever amplified by the preamplifier 6 and a reference oscillation output of the oscillator 4 are connected to input terminals of the phase measurement unit 10. The phase difference between the signals is then detected by the phase measurement unit 10 and is outputted as phase data.

Paragraph beginning at line 23 of page 21 has been amended as follows:

The block diagram of FIG. 3 shows the basic configuration for the system for ~~pattern~~ patterns 2 and 3 where, under vacuum conditions, adjustment takes place to

lower an excessively high Q-value, TOP measurement is carried out, and frequency measurement is executed using the same Q-value, or alternatively, Q-value is made high and sensitivity is increased under atmospheric conditions, TOPO measurement is carried out, and frequency measurement is executed using the same Q-value. The basic configuration for Q-control of the present invention shown in FIG. 1 is also provided with a phase comparator 11 an a voltage-controlled oscillator (VCO) 12. A displacement detection signal for a cantilever amplified by a preamplifier is input to one input terminal of the phase comparator 11 and a reference oscillation output signal from the VCO 12 is input to the other input terminal. The phase comparator 11 compares the phases of the input signals and outputs voltage values corresponding to frequency data (shifts in resonance frequency). This output is used as frequency data and sent to an input terminal as the voltage VCO 12 is input to the other input terminal of the phase comparator 11 and can be used as the forced oscillation drive source of the cantilever in place of the oscillator 4.

Paragraph beginning at line 7 of page 26 has been amended as follows:

In order to avoid the above problem, it is preferable to set the Q-value (=Q_0) ~~for close to the sample~~

for small probe-sample distances so that ΔZ is as small as possible. Specifically, if the probe is made close to the sample in advance in such a manner that $\Delta Z=1\mu m$ or less, than ΔQ becomes small and it is also possible for the loss (drop) in the Q-value shown by Q_0/Q_E to be suppressed. However, this is extremely difficult because there is a danger that the probe will collide with the sample when the probe is brought up close as far as this region manually. The present invention therefore avoids this problem with the following procedure. Namely:

Paragraph beginning at line 13 of page 27 has been amended as follows:

3) Further, after an approach, the probe and sample are separated by a ~~microscope~~ microscopic distance, the Q-curve is measured again, and an approach is made again.

Paragraph beginning at line 15 of page 28 has been amended as follows:

With related Q-control MFM, there is the problem that response is sacrificed when a high Q-control is set, and in particular, stability when measuring waveforms is lost, while when a low Q-value is used, high sensitivity of measurement of magnetic force gradient is sacrificed. In order to resolve ~~to~~ problems relating to Q-value in Q-control

MFM of the related art, the present invention provides a method of providing control so that shape measurement is performed at a low Q-value, and magnetic force gradient measurements are carried out at a high Q-value. Namely,

Paragraph beginning at line 2 of page 29 has been amended as follows:

2) A Q-curve is then continuously measured, control is exerted to put the Q value to Q2 (where Q2>Q1), and the Q-control parameters (Q-control gain etc.,) at this time are taken to be G=G2. Hereinafter, Q1 will be referred to as "low Q-value" and Q2 will be referred to as "high Q-value", which represent that the Q2 is higher than Q1.

Paragraph beginning at line 18 of page 30 has been amended as follows:

The following is a demonstrative example showing the optimization ~~optimizing~~ of a Q-value by a method of the present invention to obtain a clearly visible microscopic image. The upper part of FIG. 8 shows observations made for the surface of a hard disc in the atmosphere using SPM (at a Q-value of 400), with the left side being a TOP image, and the right side being a magnetic image for a region having 4 μm sides. With regards to this, the lower part shows

observations made using SPM exerting Q-control with a Q-value raised to 2000, where the left side is a TOPO image for the same 4μm region as the upper part, and the right side being a magnetic image of the same. As becomes clear from this comparison, there is not a significant difference in the TOPO image even if the Q-value is made high, but a markedly clearer image is obtained with high resolution for the magnetic image.

Paragraph beginning at line 18 of page 32 has been amended as follows:

In order to resolve this problem, the present invention gives consideration to providing a filter for blocking high-order frequency components in the feedback loop as shown in FIG. 11. Therefore, even if high-order oscillations are superimposed ot the cantilever for reasons such as, for example, disturbances, as a result of the action of this filter, this does not pass through a feedback system so as to cause resonance, and a state of resonance due to the fundamental wave can be maintained. In the example shown in FIG. 11, a configuration is shown where a low pass filter or band pass filter 13 is provided between the adder and the cantilever excitation means 3, and just the fundamental wave component is input to the excitation means 3. However,

erroneous operation can also be prevented by providing hte low pass or band pass filter between the variable gain amplifier 9 and the adder.